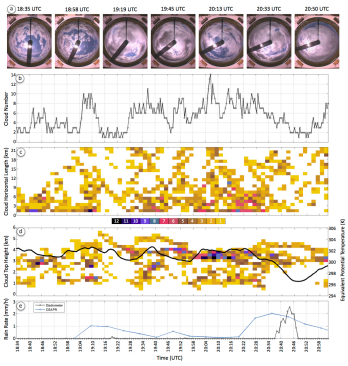
# First Observations of Tracking Clouds Using Scanning ARM Cloud Radars

## Research Highlight

Scanning cloud radars provide new opportunities to map clouds and their evolution. Specifically, these radars observe cloud particles well in advance of large droplet formation, while also capturing the clouds at spatial and temporal scales sufficient for continuous tracking algorithms. To better demonstrate the capabilities of the new Scanning ARM Cloud Radars (SACR) at the DOE Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) facility, a radar-based tracking algorithm was developed (the Cloud Identification and Tracking Algorithm – or, CITA). Our study highlights CITA development, testing and application for a postfrontal shallow cumulus event collected during the Midlatitude Continental Convective Clouds Experiment (MC3E). The 25 May 2011 event was complex and includes a wide variety of non-precipitating and precipitating cumulus cloud conditions. The case features several hours of uninterrupted radar scans of the cumulus and transitions therein. Our initial CITA methods, successes and limitations for tracking clouds unambiguously, are presented.

Several anticipated, as well as many unexpected behaviors, were uncovered during this initial application of the CITA. Not surprisingly, whenever precipitation was observed in the vicinity of the cloud radar (as also confirmed by disdrometer and precipitation radar observations), cumulus cloud elements exhibited extended horizontal length and higher cloud-top heights. In contrast, non-precipitating cloud sequences often featured strongly bimodal and/or more complex distributions of key cloud properties including cloud-top, bottom, and cloud thickness with smaller relative areal coverage.

The greatest complexity arises as these non-precipitating periods transition from shallow cumulus to congestus and precipitating clouds. Moreover, we often simultaneously capture comingled shallow convection (cloud-top heights near 2 km, in association with the top of the boundary level) and cumulus congestus (cloud-top heights near 4 km, in association with the freezing level). Soon after precipitation onset, or whenever heavier precipitating cells were nearby, the relative complexity of these tracked parameters quickly decreased, leaving only the higher topped and precipitating clouds.



A 2.5-hour long observing sequence from 25 May 2011 of (a) the Total Sky Imager (TSI) cloud images, (b) CITA total cloud number, (c) CITA cloud horizontal length distributions, (d) CITA cloud top height distributions, and (e) surface rainfall rate as from collocated ARM disdrometer and radar

### Reference(s)

Borque P, P Kollias, and S Giangrande. 2014. "First observations of tracking clouds using scanning ARM cloud radars." Journal of Applied Meteorology and Climatology, , . ONLINE.

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### Working Group(s)

Cloud Life Cycle